

Patent Application
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for

LEAK-PROOF DRINKING CONTAINER

Background-Field of the Invention

This invention relates to a closure for a liquid container and is particularly concerned with closures which remain in place while drinking, are leak-proof, easy to clean, and do not contain a valve.

Background-Description of Prior Art

In some prior art arrangements, the closures have an outlet passage containing an opening. Within the outlet passage there is a membrane which is slit creating a valve which can be activated by suction from the user. When suction is applied, the slit forms an opening and provides a flow opening for withdrawal of the contained liquid. The disadvantage of prior art arrangements of this approach is the membrane requires a secondary operation (formation of the slit) during manufacturing. Another disadvantage is the membrane becomes distorted over time and loses its ability to form a leak-proof seal. Other prior art arrangements contain a tube or liquid passage from which the contained liquid is withdrawn by suction from the user. An example of this type of prior art would be U.S. Patent 4,795,052 and U.S. Patent 4,915,250. The disadvantage of prior art arrangements of this approach is the tube or liquid passage is difficult if not impossible to clean and it is a multi-piece structure. Another prior art arrangement is shown in WIPO publication number WO 01/12031 A1

in which Samson discloses a closure with a tubular passage formed by the insertion of a plug into a spout. The disadvantage of this prior art is the closure requires multiple pieces to function and it requires disassembly for cleaning.

Objectives and Advantages

The main objective of the present invention is to provide a closure which overcomes the disadvantages previously stated.

Another objective of the present invention is to provide a closure for a container, specifically designed to handle liquids, that provides a means of communication between the interior and exterior of the container only when withdrawal of the liquid is desired.

It is a further objective of the present invention to provide a closure which does not require a self-sealing slit or any other type of valve, is a simple one-piece structure, and is easy to clean.

Drawing Figures

Fig. 1 is a top view of a closure for a leak-proof drinking container.

Fig. 1A is the cross-sectional view taken as indicated by section line A-A applied to Fig. 1.

Fig. 1A' is the same cross-sectional view as Fig. 1A, showing the container attached to the closure.

Reference Numerals in Drawings

- 10 Closure
- 11 Recessed channel
- 12 Container
- 13 Outlet passage
- 14 Fluid exit
- 15 Fluid entrance

Summary

A closure for use in dispensing a liquid from a container. The closure and container together form an outlet passage opened at both ends. When the container is overturned, the liquid will begin to flow into one

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Referring to the drawings, the leak-proof closure of the present invention is indicated as reference numeral 10. The closure 10 may be made of materials such as polypropylene, polyethylene, thermoplastic rubbers, or a combination thereof and can be reusable or disposable. The closure 10 is circular in shape, having a substantially planar cover portion and may vary in size depending upon the size of the container 12. The closure 10 is shown without a vent means. If a vent is used, it will require a vent which opens at a predetermined pressure differential between the interior and exterior of the container 12. When container 12 is overturned a partial vacuum will be created in the container 12. The vent must not open as a result of this partial vacuum or liquid can leak from the container 12. However, when in use, the liquid will be withdrawn from the container 12 creating a greater partial vacuum. The vent must open at this greater partial vacuum. The recessed channel 11 can be part of closure 10, container 12, or both. When container 12 and closure 10 are assembled by a friction fit or mating threads, outlet passage 13 is formed. It might be desirable to insert mold or over mold a thermoplastic rubber or other flexible material onto either the closure 10, the container 12, or both in the area where outlet passage 13 is formed. This would allow for an improved seal between the closure 10 and the container 12. The volume of outlet passage 13 should be approximately .060 cubic inches or greater. A volume less than .060 cubic inches would increase the probability of the liquid leaking from the container. The cross-sectional area of outlet passage 13 should be large enough to provide for easy withdrawal of the liquid from the container 12. The cross-sectional area of outlet passage 13 should be small enough to prevent air bubbles from flowing past the liquid in the outlet passage 13 when container 12 is overturned. It might be desirable to vary the cross-sectional area of the outlet passage 13 making it smaller in some areas and larger in other areas. It might also be desirable for the outlet passage 13 to have a textured surface finish. The outlet passage 13 has two ends, fluid entrance 15 and fluid exit 14.

* The recessed channel 11 is shown in unity, however it might be desirable to have multiple recessed channels which terminate at the same point or in close proximity with one another. The closure 10 is shown without a spout, however it might be desirable have a spout with a through hole which would provide for communication between the end of the spout and fluid exit 14.

gA- Operation-Figs. 1 through 1A'

Container 12 and closure 10 are molded or manufactured then assembled. Recessed channel 11 is part of container 12, closure 10, or both. Outlet passage 13 is formed when container 12 and closure 10 are assembled. When withdrawal of the liquid in the container 12 is desired, external suction is applied at the fluid exit 14 of outlet passage 13. This allows for delivery of the contained liquid which flows into fluid entrance 15, through outlet passage 13, and out of fluid exit 14. When the suction is released the liquid in outlet passage 13 will return to container 12 due to the partial vacuum in container 12. When container 12 is overturned, liquid will begin to flow into outlet passage 13 at fluid entrance 15. The displacement of liquid from the container 12 will create a partial vacuum in container 12. This partial vacuum will prevent the liquid from reaching fluid exit 14, thus it will not leak.

Summary, Ramifications, and Scope

The closure of the present invention provides the following advantages over prior embodiments:

- 1) The closure is leak-proof.
- 2) It will be possible to withdraw liquid from the container in a normal manner without removing the closure from the container.
- 3) The closure is a simple structure and may easily be manufactured on conventional plastic forming machines.
- 4) The closure is a safe device and can be used by small children.
- 5) The closure does not require a valve.
- 6) The closure is one piece and it can be easily cleaned.

While embodiments of the invention have been described in detail, it is understood that other modifications and various embodiments thereof may be devised by one skilled in the art without departing from the spirit and the scope of the invention, as defined by the claims.